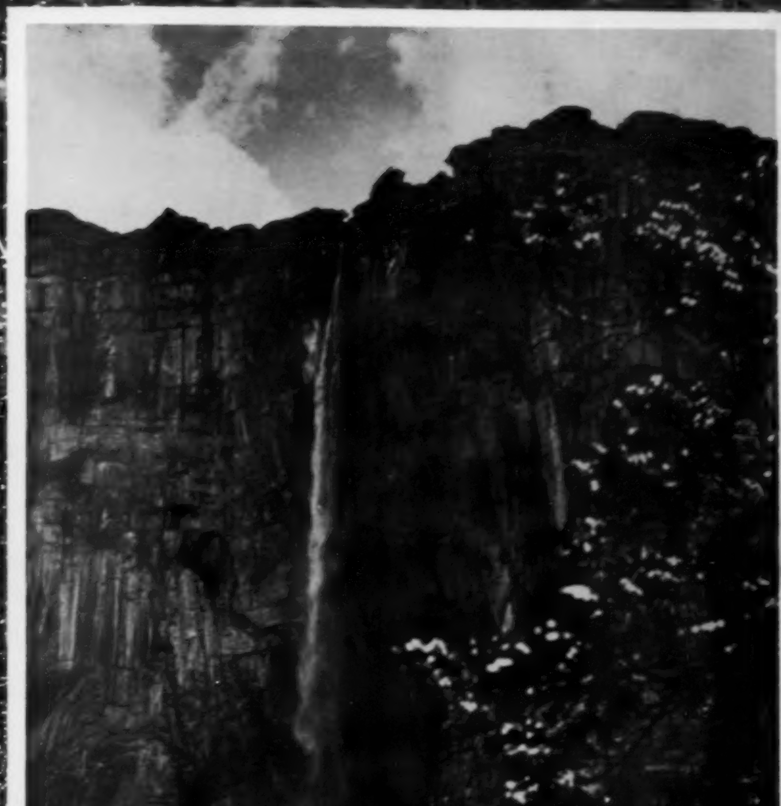
# The Earth Science DIGEST



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July, 1953

# The Earth Science Digest

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***IN THIS ISSUE***





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# Young Earth Scientists

by H. P. Zuidema, Staff Member

Leaders in the earth sciences have, in several issues of the *Digest*, deplored the lack of emphasis on the earth sciences in the secondary schools, asserting that the nation must look to the talent that is now in the grade schools if our mineral-dependent economy is to survive.

Here and there across the country good work is being done by individual teachers, who are introducing their youngsters to the rocks, minerals and fossils, despite the restrictions of fixed curricula.

Outside the classroom, too, there are individuals who have found a way to provide basic instruction in the earth sciences. Finding himself in a natural laboratory containing all the elements for good teaching, Kenneth I. Ross, of Mancos, Colorado, formerly of the National Park Service, has made the most of it.

Ross, a Board member in the early days of the *Digest*, lives within sight of the LaPlata Mountains and their ore deposits; the great tableland of Mesozoic rocks, Mesa Verde, looms above his back yard, and within driving distance are the vast canyons of the San Juan and the Colorado Rivers, where early man built his villages on rocks that contain the bones of dinosaurs.

Several years ago he decided to make this outdoor laboratory of the "Four Corners" land of Colorado, Utah, New Mexico and Arizona, accessible to youngsters, with ample opportunity for exploration, digging, and collecting. With all safeguards against mishaps taken into consideration, he accompanies boys from 13 to 17 in collapsible, rubber boats down the rivers all the way to Lee's Ferry, where trucks meet them and return the expedition to the main camp in the La

*The expedition of young "geologists" passes a great exposure of the Navajo sandstone (Jurassic) on the Colorado. (Zuidema)*

*Young geologists on Colorado River above Lee's Ferry. (Zuidema)*

Platas, by way of the Navajo trading posts and the Hopi villages. The writer went along to observe the program and discovered that, with little motivation, the average American boy is genuinely interested in the earth beneath him and quickly becomes absorbed in delving into its secrets.

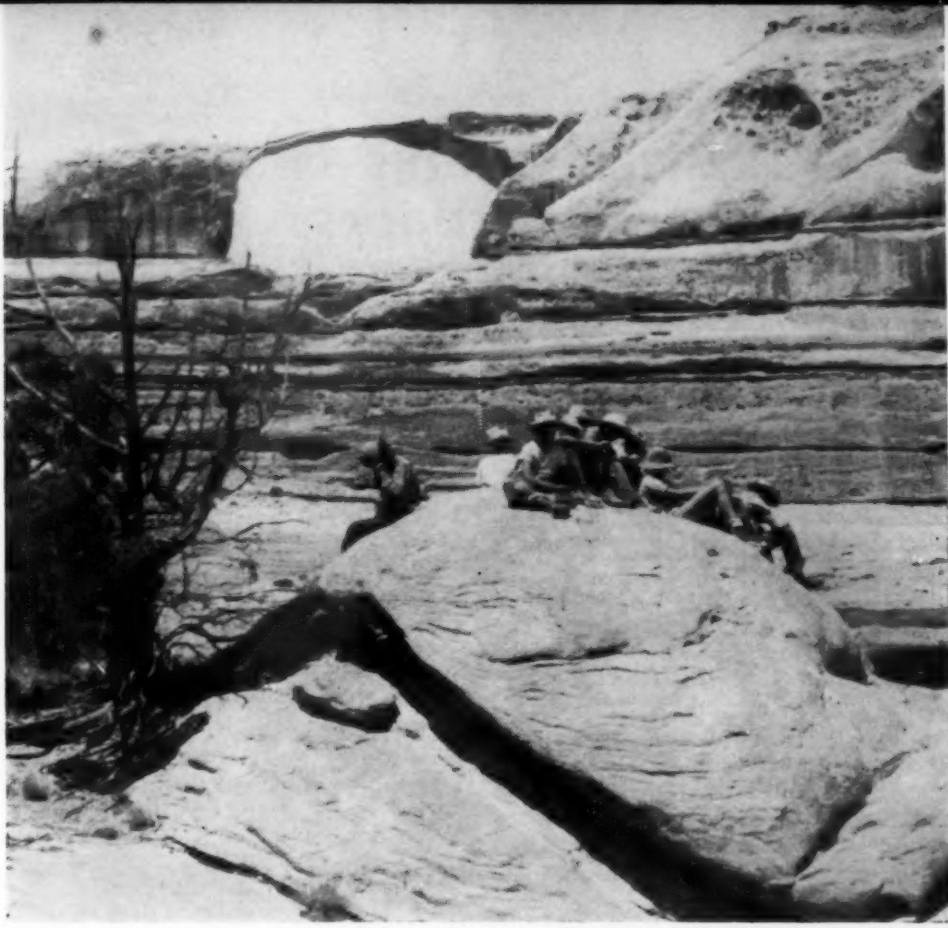
This summer, starting June 27, Ross again will take 36 youngsters into the LaPlatas, down the rivers, and finally to the "Cibola City" ruin, the only "Stone Age Boy's Town" in the world, and farthest north of the pre-historic pueblos that have been discovered. As a break from exploring activities, they will join several hundred Navajos in the annual "Entah" celebration at Lukachukai on July 24. At camp, elementary mineralogy and paleontology prepare the boys for their field work.

Geiger counters will be carried along this summer, as the route leads through an area where deposits of uranium are being worked and where additional deposits remain undiscovered.

In a report to his parents, one of the expedition members on last year's trip gives this sidelight of the summer's activity:

"Explorer Arch, probably the most important discovery of the group that went into Salt Creek, was first seen from a point only half a mile above camp at Alamo Park. Such is the complicated nature of the great walled alcoves here that it would have been easy to have passed by and never have seen it at all.

"Curiosity about what lay beyond a 10-foot wide notch in the right wall of the canyon caused the party leader to climb a short, steep talus slope. There, high atop the far wall of a long alcove, a magnificent white stone arch soared against the blue sky. It is impossible to convey on paper the thrill of that first view. One glimpse brought an involuntary shout, 'This is IT! Come on up, everybody.'



*Explorer Arch (Photo by K. I. Ross)*

"All of us had recently seen Rainbow Bridge. Some had seen several of the other famous natural arches of the Southwest. But, for perfection of color and form; for position and sheer, singing beauty, this one topped them all. Carved by the elements in the topmost layer of white sandstone, it rises from the left out an of underlying section of bright red; sweeps sharply upward into a long, threadlike span and descends in a graceful curve to join the white cliff on the right.

"Its exact measurements remain unknown, but roughly estimated, its height from the floor to the underside of the span is 80 or 90 feet and its length from foot to foot exceeds 100. The thickness at the center of the span is no more than five feet and its width is about 7 or 8 feet. Its position in the top of a wall separating two canyon alcoves makes it one of the three or four most spectacular and impressive arches yet discovered. We've named it Explorer Arch."

The summer program has attracted youngsters with an interest in geology from far and wide. Last year's roster included boys from coast to coast. Land Lindbergh, son of "The Lone Eagle," came all the way from Connecticut. Others came from Los Angeles, Santa Fe, Haines City, Florida; Excelsior, Minnesota; Wichita, Kansas; Chicago, Bronxville and Detroit.

The program closely follows that instituted years ago by Dr. Ansel F. Hall, former head of the Park Service educational division, when he began taking groups of California students into the High Sierra and later into the Monument Valley region, which now is part of the country where the young explorers, guided by Ross, "get" their geology directly from the rocks.

# Arkansas Ozarks—and No Razorbacks

by Harry Adams, President, Mineralorist Society of Joliet

Recently, the writer had an opportunity to study the region of the Ozark Plateau and the Ouachita Mountains. They make an ideal vacation spot for the Rock Hound. In the south-central part of the "Interior Lowlands" are these two mountain systems separated by the Arkansas River. Within the Ozark Plateau is the Springfield-Salem Plateau, the Boston Mountains and the St. Francis Mountains.

The Ozark Plateau area is similar to the Appalachian Plateaus. The southern side is an escarpment called the Boston Mountains with the Ouachita (Wash-i-taw) Mountains corresponding to the Folded Appalachians. The St. Francis Mountains lie to the eastern edge of the Nashville Basins. The Ozark dome in the St. Francis Mountains is higher than the others and has had all of the sedimentary formations eroded from the summit.

The Boston Mountain people resemble those of the Cumberland Plateau of Kentucky. Because the land is rugged and the soil poor, most of the land is forested and a large part of it belongs to the National Forests. The land is "open range" grazing for livestock. Isolated spots are cultivated and privately owned. Corn, hay and poultry raising has become an important industry. Farmers get most of their cash income getting out railroad ties, mine props, fence posts and from some lumbering in the national forests. The isolation in such rugged terrain has retarded economic and social progress. However, REA has brought electricity to even the most remote parts of the hills.

The famous Joplin part of the plateau has about exhausted its galena deposits. Wasteful methods of mining have caused much ore to be lost to man forever. The zinc-mining methods have also been wasteful. Manganese is mined near Batesville, Arkansas. The St. Francis mountain district contains the leading barite producing area of the United States. At Malvern, Arkansas is a large plant processing barium deposits for use as "mud" in petroleum drilling. The tripoli deposits of southeastern Missouri and the adjacent part of Oklahoma are among the largest worked in the country. In the extreme northeastern part of the Missouri Ozarks, local sand deposits have given rise to glass manufacturing. At Bauxite, Arkansas, is the country's largest deposit of aluminum ore which is rapidly being excavated. At Granite, Missouri, in the St. Francis Mountains, beautiful light-red granite is quarried and processed. Many caves dot the Ozark region. Near Van Buren, Missouri, is Big Spring State Park where the world's largest spring flows up to four-hundred-eighty-six million gallons daily.

Near Murfreesboro, Arkansas, is the old diamond mine where for a fee you may hunt a sparkler. First, you had better study up on how to search for this gem before going, so you will take the right equipment.

To the most sophisticated, Marble Falls, Bull Shoals Dam and Ten Killer Dam will make the trip more worthwhile, but to the Rock Hound, the Pebble Pup or the Mineral Hen, the climax to the region is the Ouachita Mountain quartz crystal collecting area. Nice crystals can be found, but the best specimens are mined. Roadside stands, full of crystals of all sizes, make one wish for a truck and a rich uncle. The crystal area is at its best west of Hot Springs, near Crystal Springs. The most famous mineral deposit of Arkansas, however, are the Hot Springs which have been set aside for all as a National Park area. You'll make no mistake in planning a trip into this region.

# Indian Mining and Use of Lead

by Dr. H. W. Kuhm

The recent announcement by the United States Geological Survey that it has completed a new report of the geologic structure and ore deposits of the Upper Missippi Valley lead-zinc district is pertinent to this article. These studies were begun in 1942 and are still in progress to provide new detailed information of the geology of the district and the nature of the ore deposits.

This Upper Mississippi Valley lead district, which contains 2,500 square miles in southwestern Wisconsin, northwest Illinois and northeast Iowa, produced most of the country's lead from 1830 to 1870. About 90 per cent of the area of the Upper Mississippi lead deposits is in the Wisconsin field, comprising Grant, Lafayette and Iowa counties.

The Niagara escarpment flanks the lead region on three sides without at any point penetrating it. A soft rock layer of Maquoketa shale intervenes between the Niagara and the Galena-Trenton limestone, which is the formation containing the lead deposits. Lead minerals are usually associated with zinc minerals, there being few places where the minerals of one group occur without the other. In the Wisconsin district the lead and zinc ores occur together in irregular masses in limestones, where the lime has been dissolved and the cavities thus formed filled with secondary deposits of galena.

H. R. Schoolcraft visited the region in 1820 and narrates thus of the deposits: "The ore found is the common sulphuret of lead, with a broad foliated structure and high metallic luster. It occurs massive and disseminated, in a reddish loam, resting upon limestone rock, and sometimes is seen in small veins pervading the rock, but it has been chiefly explored in alluvial soil. It generally occurs in beds and veins which have no great width, and run in a certain direction 300 and 400 yards—then cease, or are traced into some crevice in the rock, having the appearance of a regular vein. At this stage of the pursuit most of the diggings have been abandoned."

Southwestern Wisconsin, and that part of Illinois adjoining it on the south, together with an adjacent portion of Iowa, were long famous for their lead mines. There appears to be no record of the Indians having worked these deposits previous to the advent of the white man, or that the Indians of this area understood the art of smelting the ore. It seems certain that the French visited the lead region as early as 1683, and probably taught the Indians how to smelt the ore. A century and a half after the first visits of the French, the Sac and Fox Indians were producing pigs of lead, in considerable quantities, for trading purposes with the whites.

The Upper Mississippi lead mines were worked by the native Indians from early times. As early as 1690, Nicholas Perrot reported the existence of a rich lead mine on a branch of the Mississippi. There is evidence that lead was also being taken out by the Indians near the Wisconsin River, for in 1766 Jonathan Carver saw quantities of the metal in the Sac village, near Blue Mounds.

Nicolet visited the Wisconsin and Illinois Indians in 1634, and doubtless was the first to teach them the use of gun-powder. Radisson and Grosilliers followed in 1658, and heard of lead mines among the Boeuf Sioux, apparently in the neighborhood of Dubuque. In 1673, Joliet and Marquette, when stopping with their voyagers at the Indian town of Kaskaskia, must again have given the Illinois an example of the use of fire-arms and the utility of lead, if, indeed, this tribe had not already had some traffic in the ore with wandering traders and coureurs des bois operating at the head of the

Mississippi River or Lake Michigan, of whose presence in the region we catch faint glimpses in the earliest records of exploration.

The map made by Jonathan Carver, as a result of his Northwestern travels in 1766, places lead mines at Blue Mounds, just south of the Wisconsin River. He found ore in the streets of the "Great Town of the Saukies," about the site of the present Prairie du Sac, and appears to have ascended the princpal mound, which he says "abounded in lead."

Mining by the Indians was carried on crudely at many points in the lead region throughout the 18th century, as the pock-marked condition of the terrain when the first white miners arrived would suggest. About 1824 Lt. Martin Thomas, superintendent of the western lead mines, visited the Upper Mississippi mines and found the Sac and Fox Indians working the lead diggings. "The squaws are the miners," he reported. "Some of them smelt their ore in Indian furnaces."

When pioneer American miners entered the lead district, they found it perforated with ancient shallow diggings, and encountered Indians still engaged in scooping out lead ore "near the grass roots," using stone picks, bone spades, wooden shovels and gun barrels for crowbars. The Indians only skimmed the surface as a rule, although occasionally they drifted into hillsides for some distance, and when they reached "cap-rock", would build a fire under it and then crack it by dashing cold water on the heated surface.

Their tools, in the earliest times, were buck-horns, many of which were found in abandoned drifts by the early white settlers. Later they obtained hoes, shovels and crow-bars from the traders to whom they sold the lead. The Indians loaded their ore at the bottom of the shaft into tough deer-skins, the bundle being hoisted to the surface or dragged up inclined planes by long thongs of hide.

Many of these Indian "leads," abandoned by the aborigines when the work of developing them became too great for their simple tools, were afterward taken possession of by whites and found to be among the best in the region.

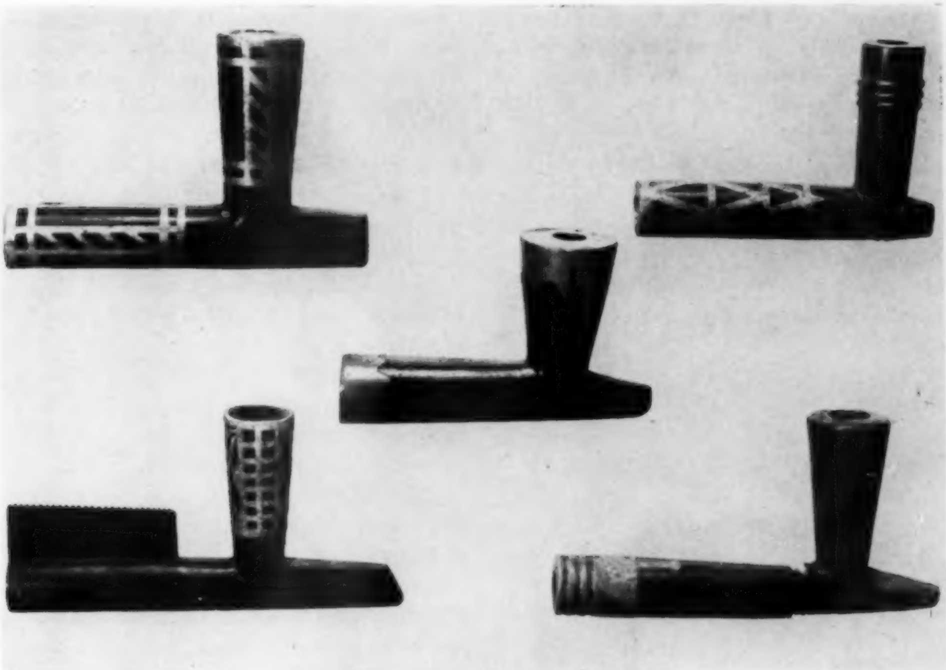
Early writers generally agree that the Indian mining was almost wholly conducted by old men and squaws, the bucks doing the smelting. However this may be, it is certain that in later days many bucks also worked in these primitive mines.

Between 1815 and 1820, Capt. John Shaw visited the Fever River mines on several occasions, and there saw the Indians smelting lead in rude furnaces. He writes that at one time he bought seventy tons of Indian-smelted metal from them "and still left much at the furnace."

In 1820 Schoolcraft declared further that "the lead at these mines is now exclusively dug by the Fox Indians, and, as is usual among savage tribes, the chief labor devolves upon the women. The old men also take part in these labors, but the warriors and young men hold themselves above it. They employ the hoe, shovel, pickaxe, and crow-bar in taking up the ore. These things are supplied by the traders.

"No shafts are sunk, not even the simplest kind and the windlass and buckets are unknown to them. They run drifts into the hills so far as they can conveniently go without the use of gunpowder, and if a trench caves in it is abandoned. They always dig down at such an angle that they can walk in and out of the pits, and I descended into one of these which had probably been carried down for 40 feet. All this is the work of the Indian women and old men.

"When a quantity of ore has been gotten out it is carried in baskets by the women to the banks of the Mississippi, and then ferried over in canoes to the island, where it is purchased by the traders. The traders smelt the ore upon the island in furnaces. Formerly the Indians were in the habit of smelting their ore themselves, upon log heaps, by which a great portion was converted into what are called lead ashes and



***Lead Inlaid Pipes from Wisconsin***

thus lost. Now the traders induce them to search about the sites of these ancient fires, and carefully collect the lead ashes, for which they receive $1 per bushel at the island, payable in merchandise."

Dr. Moses Meeker, in his Early History of the Lead Region, describes the smelting of lead near Galena, Illinois. About 1822, the Sac and Fox Indians used log furnaces, in western Wisconsin, for the purpose of smelting lead, having been taught this by the early French and Spaniards.

At first the Indians reduced the mineral by throwing it on top of large fires. Large logs would be placed on the ground and smaller pieces of wood piled around and the ore heaped on. The fire would be set in the evening, and in the morning shapeless pieces of lead would be found in cakes, or in small holes scratched in the earth under the logs; or sometimes in shapeless masses.

Gradually the aborigines improved upon this crude process, and left upon the earth's surface evidence of the primitive smelters used by them. These were made by digging in a hill slope a hopper-like pit two or three feet wide at the top, the sides sloping toward a point but stopping short when the bottom was still some eight inches in width. The sides of the opening were lined with flat stones while longish narrow ones were laid grate-wise above the bottom. A trench, called the "eye," was dug from the lower side, extending under the bottom of the hopper. This trench was filled with dried wood, brush, and other material while the hopper was filled with ore. When the fuel was fired the ore melted down in part and the molten lead fell through the stones at the bottom of the hopper, through the fire trench, and was caught in a tiny pool scooped out near its lower end. When the whites began operations in the mines, their furnaces were practically identical with the later Indian furnaces. In 1815 about twenty rude furnaces were said to be in operation by the lead miners in the vicinity of the present site of Galena alone.

Reuben Gold Thwaites, in his Notes on Early Lead Mining, states that "no evidence exists nor is it probable, that the aboriginal inhabitants of the Upper Mississippi Valley made any considerable use of lead previous to the appearance among them of French missionaries, explorers, and fur-traders. The French were continually on the search for beds of mineral, and questioned the Indians very closely regarding their probable whereabouts. The savages, although superstitious

***Plains Indian Pipes Inlaid with Lead***

with regard to minerals, appear soon to have made known to the whites the deposits of lead in the tract which now embraces the counties of Grant, Iowa and Lafayette, in Wisconsin; Jo Daviess and Carroll counties in Illinois; Dubuque county, in Iowa, and portions of eastern Missouri. The fame of this rich lead bearing region, when once brought to the notice of the pioneers of New France, became widespread. The French introduced firearms among the Northwestern Indians, and induced them to hunt, on a large scale, fur-bearing animals; thus lead at once assumed a value in the eyes of the latter, both for use as bullets in their own weapons, and as an article of traffic with the traders."

As Charles E. Brown, in his Notes on the Occurrence and Use of Lead Implements in Wisconsin, succinctly states: "Considering the extent of the lead deposits in southwestern Wisconsin and in the adjoining portions of Illinois and Iowa, and which several tribes now or formerly resident in this region are known to have worked in a primitive manner, it is surprising that so very small a number of articles made of this mineral have been discovered in this state. Among these articles are a boatstone; a number of disk-shaped beads; a cone; a small number of pipes, and several turtle-shaped effigies. The pipes are of such form and workmanship as to indicate that they were fashioned during the historic period. Fragments and small lumps of galena have been obtained from Indian village sites at various places in the Fox-Wisconsin Valley, and in other sections of the state. They have also been obtained from burial places. It is highly probable that lead was exchanged in prehistoric times between the local Indians and those of the Ohio Valley. The Indians of the latter region may themselves have visited the lead region to obtain the ore."

For further data on the aforementioned lead pipes, one scans George A. West's monumental work on "Tobacco, Pipes and Smoking Customs of the American Indians," and finds that "a considerable number of lead pipes, patterned after Indian forms, have been found in Wisconsin and adjoining states. This can be accounted for from the proximity of the lead mines. An examination of a dozen or more pipes, made of lead, reveals the fact that many of them were cast in well-made moulds. Others were carved from pieces of the metal. These

***Plains Indian Pipes Inlaid with Lead.***

carved pipes are elbow shaped, unornamented, and show evidence of being scraped into shape. All lead pipes have a stem cavity at about right angles to that of the bowl.

Writing of leaded and lead-inlaid pipes, Mr. West notes that "lead was frequently employed by the Indians of the Upper Mississippi-Great Lakes Area in decorating and mending Calumets and other types of pipes. In some instances, the bowl, made of one piece of stone and the base from another, were neatly joined and held together by inlays of lead. This applies more particularly to the Siouan type.

"In view of the knowledge we possess at the present time, it is reasonable to assume that the Indians of the Upper Mississippi-Great Lakes Area had not learned the art of smelting lead previous to the advent of the white men. Further, we know that lead had to go through the smelting process before it could be used for inlay work. The conclusion must then follow that metal-inlaid work on pipes, whether for ornaments or repair, is the result of contact with the white man.

"In preparing the stone pipe for inlaying, the grooves, circles and figures are cut out to the depth of an eighth of an inch or more and at an angle which leaves the bottom of the cut a trifle wider than the top, this forming a dove-tail. In most cases, melted lead is poured into the excavations, allowed to cool, and then smoothed down and polished. In some instances of repair, the lead was crowded into the grooves in cold form.

"The Indian appreciated the fact that catlinite and steatite stand the heat of molten lead without injury to the edge of the excavation. With limestone it is found that the leaded part never has a finished smooth surface, as the part of the limestone coming in contact with the hot lead tends to become calcined and chalky."

Many of the Calumet pipes of the Great Lakes region are ornamented with geometric designs, inlaid with lead in many instances. In almost every collection may be found pipe-bowls that have been broken and mended by cutting grooves and filling them with lead. In many instances the work of repair entailed more labor than would have been necessary in the making of a new pipe, which may indicate that the pipe-

*(Concluded on Page 26)*

# Pothole Erosion

by Roger L. Spitznas, 1906 30th St., Moline, Ill.

*Abstract*: Potholes scoured into granodiorite along Little Kimshew Creek near Ramsey Bar, Butte County, California, afford opportunity for study of the conditions of pothole erosion. Durability and homogeneity of the bedrock favor development of symmetrically shaped potholes. Large quantities of rock debris, the cutting tools of pothole erosion, are available from only two rock types. The size-range of clastic particles in the stream load is wide. The creek flows across successive treads and risers along a stair-like channel where abrupt changes of gradient at the risers favor pothole erosion. Dimensional relationships of 20 potholes suggest the establishment of a stage of development classification recognizing Youth, Maturity, and Old Age.

*Definition*. To avoid problems in interpretation arising from varied use of the term *pothole*, usage in this report is restricted to those holes scoured by clastic cutting tools carried by rotary currents which operate about a vertical or nearly vertical axis. This usage corresponds to "normal potholes" of Elston (1918, p. 37) and to "eddy holes" of Alexander (1932, p. 307).

*Location*. The Ramsey Bar area is located on the west slope of the Sierra Nevada in northeastern Butte County, California, approximately 25 airline miles northeast of Chico, California, and approximately 40 airline miles south of Lassen Peak, Lassen Volcanic National Park.

*Physiography*. Deep marginal canyons surround and delimit a relatively flat upland which slopes southwestward. Maximum relief on this upland in the Ramsey Bar area is approximately 5,250 feet, and local relief along Little Kimshew Creek is approximately 400 feet. On the upland, the gradient of Little Kimshew Creek averages 115 feet per mile, which is less than the gradient of Kimshew Creek to which the Little Kimshew is tributary. This anomalous relationship of gradients results from a second cycle of erosion now occurring in the region.

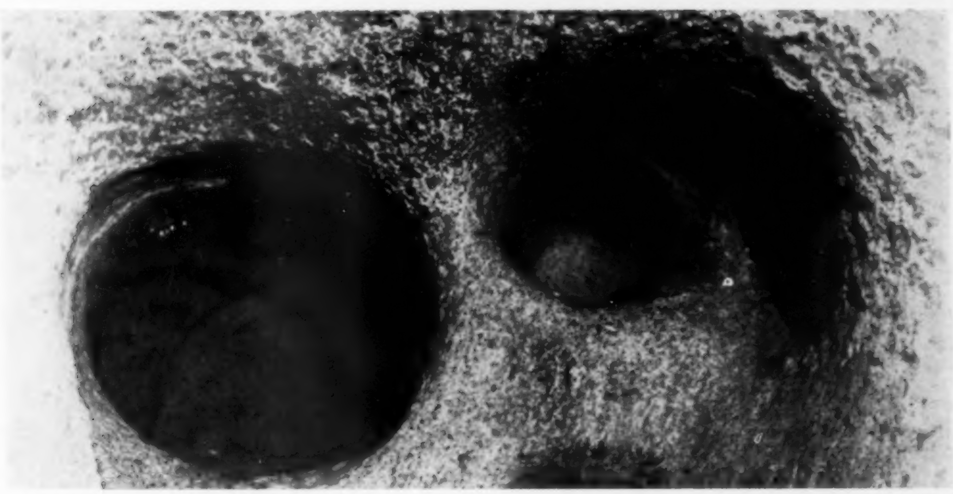
*Conditions of Pothole Erosion*

Pothole erosion as a distinct type of stream erosion requires balanced interaction of the many discrete elements of stream and bedrock. This balance once established must be maintained or re-established for continued pothole erosion—the duration between successive periods of balanced interaction may be daily, seasonal, or longer.

*Stream*. This specialized type of rock corrosion seem a function of youthful stream conditions wherein gradients and load favor pothole erosion. The pothole cycle, presented later, advances synchonously with the stream cycle; but advance of the stream cycle toward or into Maturity may halt pothole erosion by reduction of irregularities in gradient, by reduction of stream velocities, and by reduction of clastic load.

Stream profiles, flow type, as well as volume and velocity are elements of the stream which influence pothole erosion. Potholes along Little Kimshew Creek are found only on the risers, areas of local gradient increase and channel constriction. Alexander (1932, pp. 324 and 335) notes the occurrence of potholes along areas of increased gradient at Taylor's Falls, Minnesota. Though the cause is different, effects of local baselevel controls above the risers are similar to those described by Alexander. Namely, size sorting incident to aggradation along the treads permits large quantities of gruss sand to move across the treads to areas of pothole erosion but restricts the quantity of coarser fragments reaching the riser next downstream.

Turbulent and violent flow seem nec-

*Top—General view of a portion of the Upper Area. The numbers indicate the potholes shown, and the Upper Area Complex is seen at the upper right.*

**Bottom Left: Pothole 31. Right: Pothole 30, Upper Area.**

*(All photos are by the author)*

essary for development of vortex currents and the motive force for movement of cutting tools. Spiral bottoms found in potholes 20 and 22, plus current action seen in several holes, attest the action of spiral vortices in pothole erosion along the Little Kimshew.

Assuming discharge variations along the West Branch of Feather River to be typical of streams throughout the region, turbulent flow and rapid variations of volume are to be expected along the Little Kimshew; for during the early months of the year discharge of the West Branch changes from a few second-feet to over a thousand second-feet from day to day. An excellent treatment of macroturbulence may be found in Matthes (1947).

*Bedrock.* No single rock type possesses exclusively favorable properties promoting pothole erosion, for potholes occur in sedimentary, igneous and metamorphic rocks.

The granodiorite along Little Kimshew Creek is grossly homogeneous relative to pothole sizes and promotes formation of highly symmetrical potholes. Joints which strike obliquely across the stream have localized risers along the channel, but no localization of individual potholes by jointing is indicated. The granodiorite weathers to a thick gruss which contains a goodly proportion of quartz. Andesite flows in the headwater region weather to coarse fragments—pebbles and larger grade sizes. Gruss sand and andesite fragments comprise ninety per cent or more of the clastic load of Little Kimshew Creek.

*Cutting Tools.* Extensive pothole erosion along any stream requires use of some common element of the clastic load as cutting tools. A balance of supply, use, and discharge of cutting tool materials must exist; for oversupply will cause filling of the holes, and undersupply will reduce the effectiveness of pothole erosion until lowering of the stream bed is more rapid than pothole deepening.

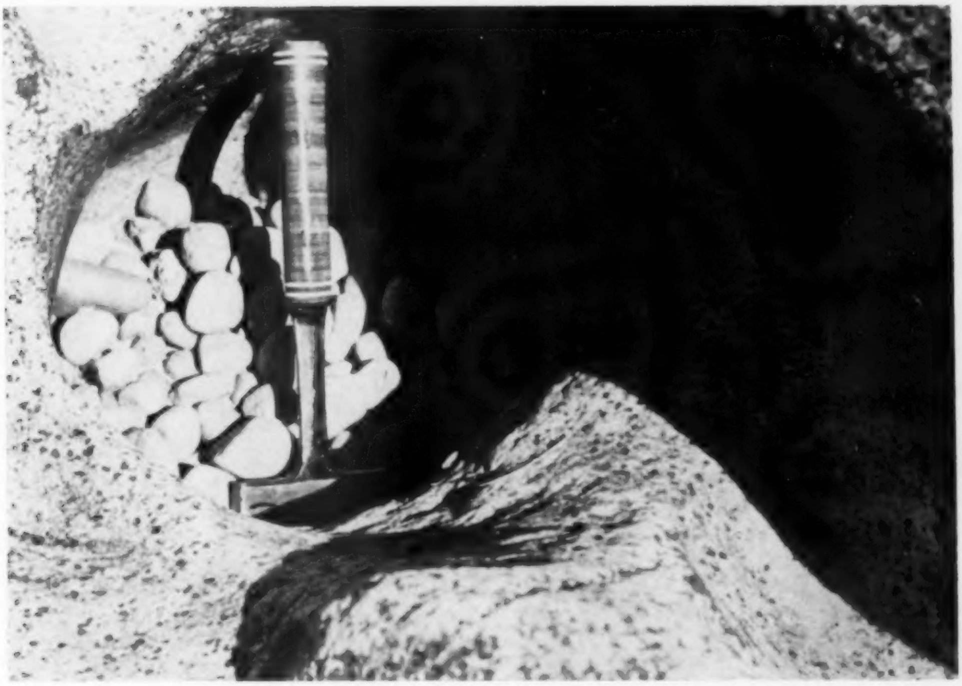
The absence of well-rounded andesite pebbles from all potholes and the absence of andesite pebbles from many holes, indicate that these pebbles are *not* the essential cutting tools. The large quantity and ready availability of gruss sand, the presence of gruss sand in all potholes, and the effectiveness with which the sand is carried to, circulated through, and ejected from the potholes demand the role of cutting tools be assigned to the gruss sands.

An earlier report by the writer (Spitznas, 1950) described potholes and channel scrolls in the Navajo sandstone in Zion National Park, Utah. In that area quartz sand was again the important cutting tool where the tools were derived from the same sandstone into which the potholes and scrolls were scoured. Following publication of this 1950 report, the U. S. Geological Survey, in late 1951 or early 1952, released Professional Paper 220 by H. E. Gregory wherein he discusses and figures (pp. 182-189) identical and similar areas in the Park.

*Pothole Descriptions.* Potholes along Little Kimshew Creek occur on three risers: Lower, Middle, and Upper areas. Upstream from each riser is a flat tread. Table I lists the dimensions of potholes occurring in the three areas. The depth-diameter ratio and the circularity are also given in the table.

Potholes 20 and 22 have spiral bottoms. In Pothole 20 the spiral is very shallow and counter-clockwise while the spiral of Pothole 22 is clockwise and approximately 15 inches deep. Flow in number 22 circulates spirally downward through a marginal clockwise channel and ascends spirally along a central, upward-expanding hemi-cone which rises 15 inches from the bottom of the hole. Water and clastic debris may be ejected after one circuit or may be recirculated with descending currents. The contour of these two holes demonstrate, in solid rock, the vortex flow and circuits produced by Alexander (1932, p. 318) in simulated potholes of his laboratory experiments.

*(Continued on Page 42)*



*Top Left: Pothole 28. Right: Pothole 29. Upper Area*

*Bottom: Pothole 20, Middle Area — See text page 14*

# New England Mining to Stage Comeback

Maine's big storehouse of undeveloped iron ores in the Mount Katahdin region are now attracting much attention locally. The old copper mine at Bluehill is also being looked over with covetous eye, and the New England Council is making a comprehensive survey of the situation, looking toward the reopening and recovery of these great natural resources.

Can they get much needed sulphur from these iron ores in Maine? The Brown Company at Berlin, New Hampshire, is already sold on the sulphur possibilities to come from Katahdin ores, and has just put into operation the first sulphur extraction plant of its kind in the east.

The Brown Company buys ores mined by the Vermont Copper Company, which removes the copper, and has no further use for the gangue refuse. For years it piled up these "tailings," (ores with copper removed) around its plant like the big sawdust piles seen around Maine sawmills.

Sulphur is almost as important to the big paper-making plants as is woodplup itself, for without sulphur the plants would immediately shut down, and there would be no work for thousands of paper mill workers.

It has long been known that sulphur is found in abundance in composition with the iron and copper ores spread around New England, especially in Maine, but nobody did anything about it as long as nearly any quantity wanted could be purchased from the mines in Louisiana and Texas at a reasonable price. It was much more costly to mine ores in New England and extract the sulphur.

The Brown Company is now producing about 50% of their sulphur requirements at their own plant, *at a price* (?) which President Whittemore is unwilling to reveal, at present, but the "peace of mind" he has in not being compelled to rely on a single source, he says, is worth it.

As a result the Freeport (La.) Sulphur Company, one of the two big producers in this Country, is already taking samples on several hundred thousand acres it has leased in the Moosehead area. Texas Gulf Sulphur, the largest sulphur company in the world, is expected to do the same thing at the old copper mines at Bluehill.

If the sulphur content of the Katahdin iron and the Bluehill copper is large enough, Maine may be the home of a new large-scale mining industry within a few years. It is one of the anomalies of the mining industry that both these mines in the old days spent hundreds of thousands of dollars trying to get rid of the sulphur in the ores, which now, since the scene has changed, other companies are spending even more to secure.

Of course, carrying the process one step further, why not at the same time recover both metals, iron and copper, as a by-product of the sulphur industry, and thereby kill two birds with a single stone. Sulphur has been a major by-product in the iron industry of Spain where only sulphide ores are plentiful, for hundreds of years, so if it has worked one way in Spain why not make it work in reverse in this country, where both iron and sulphur are so sorely needed.

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EARTH SCIENCE QUIZ NO. 7

TEST YOUR KNOWLEDGE! How much do you know? How many of the following terms can you define? They are arranged in three groups with progressive difficulty. Group 1, things everybody should know; group 2, things good "rock-hounds" should know; group 3, things which experts might be expected to know. Try your luck. To score—add up total points as indicated by the group number and rate as follows: 1-6 poor; 7-13 good; 14-20 excellent; 21 perfect; (Answers on page 44)

| | | |
|---|---|---|
| a.—(1) alloy | e.—(1) petrology | i.—(2) bonanza |
| b.—(1) brimstone | f.—(1) concretion | j.—(3) lithoglyph |
| c.—(1) vug | g.—(2) anticline | k.—(3) dendritic |
| d.—(1) chert | h.—(2) colloidal | l.—(3) borrasca |

# Symmetries and Asymmetries in Barringer Crater

**by H. H. Nininger, Staff Member**

Since this famous crater is the outstanding example of easily accessible impact scars on the earth's surface, it is important that it be critically studied in all of its natural details so that the results of those studies may be used as a standard for comparison with other features of like origin.

Since its discovery the crater has been described as round with a radial distribution of ejected material. It has also been described as "squarish" or "square with rounded corners." These latter descriptions have been dramatized by newsmen into "discovery that the crater is square and not round" as had always been believed.

The present writer has suggested that the crater has a dual structure due to its having been produced by a combination of forces: Primarily it was bi-lateral due to the intrusion of the colliding mass at a rather low

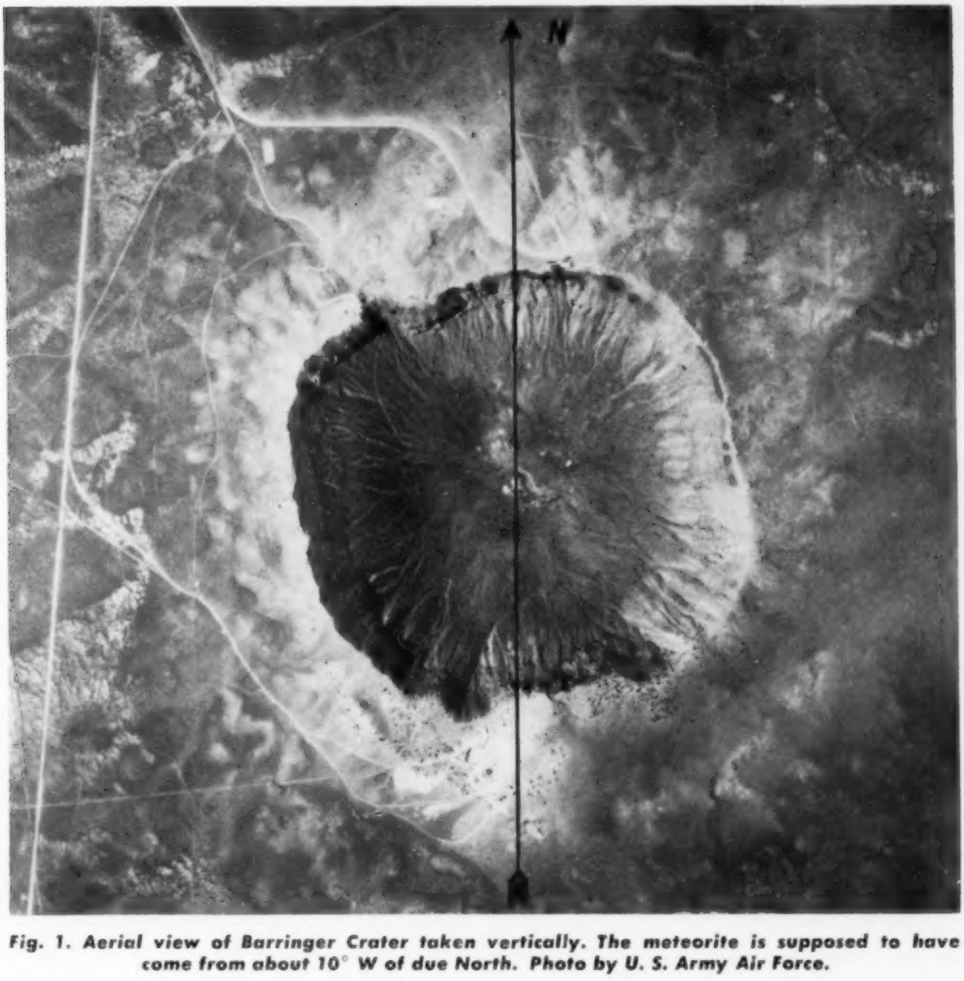



***Fig. 1. Aerial view of Barringer Crater taken vertically. The meteorite is supposed to have come from about 10° W of due North. Photo by U. S. Army Air Force.***

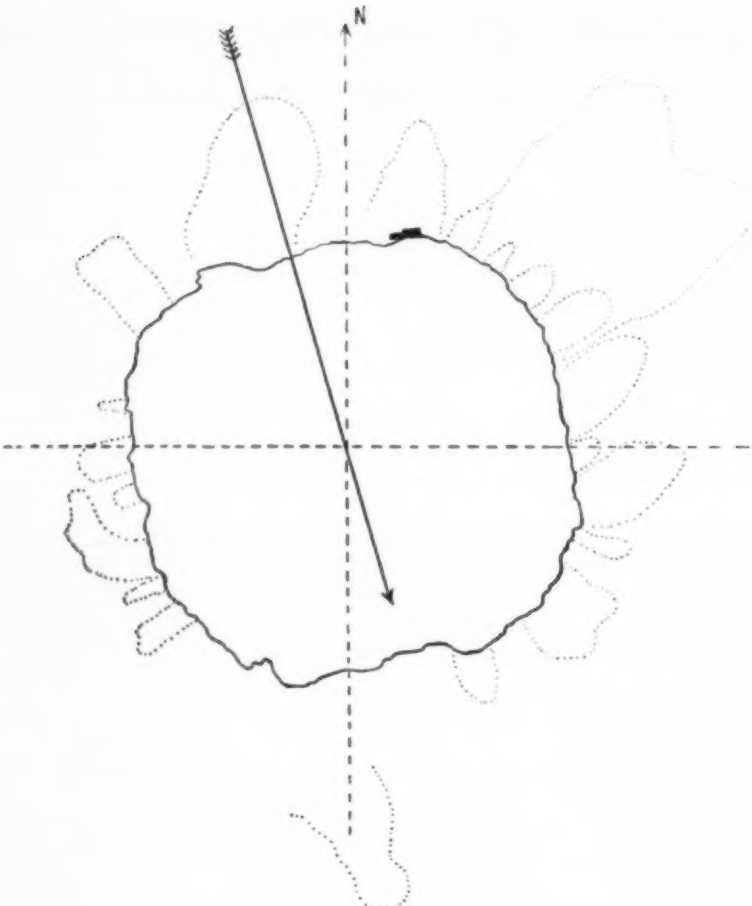
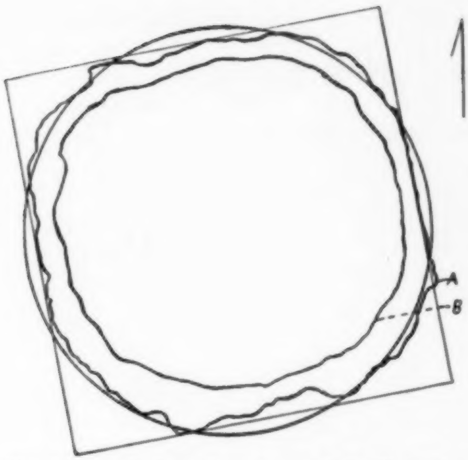



*Fig. 2. Tracing of crater's outline as shown on vertical photograph. Stippling outlines chief detectable rays of ejected rubble, showing eccentricity of several. Bi-lateral symmetry of crater outline conforms to arrow which indicates probable direction of meteorite impingment.*

angle; but immediately this form was drastically modified by the exploding of the projectile. Thus we have the steeply tilted, almost parallel east and west walls (Fig. 1) which are the result of its plowing into the earth; but the final rounded form was given by the explosion (For more detail see Sci. Monthly, Feb. 1951).

As to the circularity versus the squarishness of this famous feature a tracing is submitted herewith (Fig. 3A) made from the photo shown in Fig. 1. Superimposed on this tracing are a circle and a rectangle. The reader may draw his own conclusion as to which conforms better. Inside these three I have traced the figure of the crater, B, which appeared on the Holsinger-Barringer map in 1909 on a slightly smaller scale.

Recently, in studying the distribution of ejected rock fragments on the rim, I seemed to detect a departure from the radial arrangement of the tongues or spits of such ejecta. Thinking that perhaps this might better fit the bi-lateral pattern, I requested, in the interest of science, that the Air Force Photographic Unit expend some of its practice shots when in our part of the country on making some perfectly centered photographs of the crater. The Commanding Officer kindly agreed. Fig. 1 is a result.



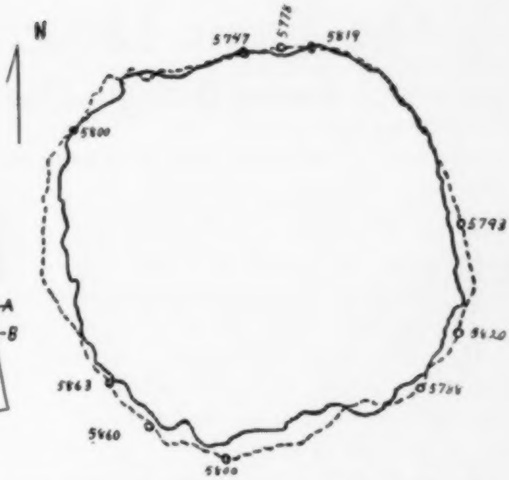




***Fig. 3. Crater Round or Square? Outline of crater rim, A, traced from vertical aerial photograph shown in Fig. 1. With it are a circle and a rectangle for comparison. Also included is a tracing of the older survey published by Barringer in 1909, B.***

***Fig. 4. Broken line, tracing of rim crest as shown on contour map of crater published in Smithsonian Misc. Coll., Quarterly Issue, Vol. IV, Part 4, 1908. Solid line, tracing of Air Force photograph.***

A careful inspection of this photograph shows several marked anomalies and these have been traced and shown in Fig. 2. Instead of fitting into a bi-lateral pattern they tend rather to bend toward the northeast. This promptly suggested that the wind may have been responsible. Records show that the wind aloft blows from the southwest 55% to 60% of the time at the Winslow airport, 18 miles east of the crater. It also reaches high velocities much of the time, especially aloft.

We concluded some years ago that the marked concentration of small meteorite fragments on the outer slope of the northeast rim was most probably due to wind action. Likewise the distribution of the metalic spheroids seems to be notably more concentrated on the east and northeast and now the dispersal of rock fragments seems to have been noticably modified by a force acting from the southwest. Wind would seem to be the logical agency to account for all of these anomalies.

In the northeast sector the spurts of ejected rubble appear to conform perfectly to the radiate pattern but on the north their axes, if projected backward, pass through the western half of the pit. On the west the pattern is confused; but the average length of the ridges is noticably less than in other sectors and at least one definite instance of deformation is discernible.

On the south one seems to see evidence of an eastward bending of the rays; but here the picture has been obscured by the operation of silica mining so that one cannot be sure.

The most convincing examples are the great boulder fields along the east side. Here the two greatest ridges lying on either side of the mid-eastern point show a very noticable departure from a true radiate alignment. If there were a corresponding alignment in the southwestern sector, thus forming a bi-lateral pairing on the axis of intrusion (shown by the arrow in Fig.2) then one might attribute the alignment to the back-fire of the explosion from a point about under the end of the arrow. However, the ejecta do not conform to this interpretation. On the whole, the departures from a true radiate alignment seem best explained as due to the prevailing wind which was, as usual, probably blowing from the southwest that day.

# The Basic Lapidary Processes
## Smoothing—Third of a Series

by Wm. J. Bingham, Staff Member

This, the third article of the series, will cover the process that is the least understood, most controversial and that causes more grief and discouragement among amateur lapidaries than any other step.

The reason for the smoothing process is that rough surfaces such as are left by the diamond saw or rough grinding wheel cannot be polished in a reasonable length of time, but by proper smoothing, a surface can be produced that can be polished quite rapidly.

Smoothing is a continuation of the grinding process in its basic aspects but with provisions for better control and in which finer and finer abrasives are used to produce finer and finer scratches until the final scratches produced are of such small size that they can be readily polished out. A properly smoothed agate surface, for instance, can be perfectly polished at a rate of not more than 3 minutes per square inch and usually in somewhat less time.

I use two smoothing processes, one for flats and one for curved surfaces. The one for curved surfaces can also be used for flats (but takes a longer time) where the materials being smoothed are such that the first mentioned method does not work.

For smoothing sawed (flat) surfaces I use the flat side of a very hard bond bakelite grinding wheel of #80 grit (yes, number eighty grit is right) which produces a readily polished surface from a sawed surface in one short operation,—one or two minutes per square inch. I use a 10" diameter by 3/4" thick Norton Wheel 37C80-P5B, mounted on my grinding wheel shaft 1900 R.P.M. See the sketch of the arrangement accompanying my article on "Grinding" in the May Issue of Earth Science Digest, page 19. The flat side of this wheel is allowed to "glaze" and care should be taken *not* to destroy this glazed condition by grinding curved surfaces or sharp corners on it. A new wheel will scratch terrifically for a while but by working on it with flat surfaces only, the necessary glaze will be developed and then it will operate without scratching.

This wheel works very well on agates and jaspers and most silicate materials but is not very good on most carbonate minerals. Keep plenty of water on the wheel as it will develop heat very rapidly if allowed to run dry. If the wheel gets clogged with grindings and doesn't cut rapidly it can be cleaned by brushing in a radial direction with water and a stiff brush (not a steel brush) or by rubbing with a piece of pumice with plenty of water.

For working curved surfaces, waterproof silicon carbide coated cloth is stretched across a flat metal face plate by a clamping ring. This face plate is mounted on the top end of a vertical shaft that is carried in two well spaced ball bearings and has the driving pulley on the lower end. The shaft does not extend thru the face plate thus leaving the abrasive surface free of obstructions. This unit is mounted in a stand or table so that the face plate is just below the table surface and is surrounded by a collecting trough or ring to collect and drain away the water thrown off by the face plate when it is revolving. This arrangement is very convenient as the table top can be built to any desired height. The flat disc arrangement provides zero speed at the center varying to a maximum at the rim, so a suitable speed can be found for any operation. From 900 to 1200 RPM for a 12" diameter face plate is a good speed.

No backing or cushion is used because if the abrasive is not forced to scratch the stone, but allowed to be deflected into a cushion, it will not cut as it designed to do and thus control is lost. The first smoothing should be done with #220 grit coated cloth, followed by #400 and finished with #600. The rough grinding scratches should be placed in one general direction on the specimen and if the #220 grit scratches are placed at an angle to these, they (the coarse ones) will be plainly visible as long as they are present and when they are gone, the #220 grit step is finished. The same method of determining when the #400 and #600 steps are finished, should be followed. By placing the finer scratches at an angle to the coarser ones, a simple glance will tell when the coarse ones are gone and the step completed.

Water from an overhead tank is piped to a nozzle just above the center of the face plate and a valve in the line is adjusted so that the nozzle drips water at the rate of 2 or 3 drops per second on the center of the face plate. It then flows radially across the cloth washing away the cuttings and cooling the stone.

There are many other arrangements used for smoothing such as horizontal shaft face plates, drums, belts, and lap wheels with loose abrasives, but they do not have the advantages in the way of convenience, cleanliness control and versatility of the vertical shaft face plate set in a table. If a jam peg is set up alongside the face plate, faceting and flat sided cabachons can be made easily as well as providing a convenient way to put accurate bevels on the edges of cabachons.

The method of smoothing a curved surface of a specimen by this process is very simple:—the specimen is held firmly in the fingers or hand with the roughly ground surface down on the revolving abrasive surface. The stone is swung in an arc by *rotating* the forearm first one way and then the other thru an arc of about 60° (depending on the shape of the stone) at a rate of about 4 or 5 swings per second and at the same time slowly moving the stone at right angles to this swinging, by bending the hand up and down at the *wrist* at a rate of once every 4 to 6 seconds. This will cause the contact point between the stone and abrasive surface to travel in a zig-zag path that will cover the area being worked on. It is best to work on a small area (approximately the size of a quarter) at a time and complete the step on that area before moving on to an adjacent area.

Finally—*never* perform any smoothing (or sanding) operations *dry* as stone dust is very injurious to your health and the lack of the water as a coolant also makes it difficult to control the heat developed in the specimen.

*Note for program chairmen: The author, William J. Bingham, is available for lectures on Lapidary and Gemmological subjects before Mineral or Lapidary Clubs and groups.*

## The Question Box

Do you have a little problem in your shop?

Questions on LAPIDARY subjects may be sent to The Question Box. Mr. William J. (Bill) Bingham of St. Paul has consented to try to answer the questions.

The following rules will apply:

1. Each question shall be submitted on a separate sheet of paper with enough blank space on it for the answer.
2. A question should have only one subject so that the answers can be short and direct. Questions requiring excessive discussion in the answers or those that can be answered by reading any of the ordinary handbooks will not be answered.
3. Each question must have the sender's name and address thereon.
4. All questions submitted become the property of the Earth Science Digest and will not be returned.
5. All questions shall be submitted to the Editor, B. J. Babbitt, 140 Northgate Road, Riverside, Illinois on or before July 15 for answering in the Sept issue.

# LET'S DESIGN

by Florence K. Renaker, 129 N. Oakdale St., Medford, Ore.

The very thought of creating a design seems a major project to many people. Actually, the theory of design is based on a few simple principles. By using them in various interpretations, more detail may be added until the design is as simple or as elaborate as desired. A design is an interesting space breaking. This gives the designer so much leeway that it usually leaves them at a loss to know how to begin.

The first of the principles of design is the use of proportion to establish a well balanced space breaking. There can be no proportion without two or more elements, for proportion applies to the relative sizes of areas or relative lengths of lines used. Through the ages certain proportions have been found to be more pleasing to the eye than others. When two different shapes are the same size, such as a square and a circle; that is said to be monotonous. An uneven proportion is better; for example, a two-to-three relationship where one area is two-thirds the size of another. (Fig. 1) This may also apply to spaces within an outline in the manner of tying a ribbon around a box. Place the ribbon off center so that one space will represent two-fifths of the length of the box and the other three-fifths. (Fig. 2)

In addition to the two-to-three proportion, the most commonly used are the two-to-five, and the two-to-seven, which are classed as harmonious. Two-to-nine, two-to-eleven, and so on indefinitely are classed as contrast. The main objective is to get varying sizes instead of those based on even sizes. The principle of varying proportions cannot be overemphasized. Often a design may be corrected and made beautiful simply by a rearrangement and adjustment of the proportions.

A second principle of design is balance. We have balance of area, balance of line, and balance of interest. It is no longer considered necessary to have equal areas to balance one another. The small unit removed some distance from the large unit frequently does just as well in balancing because of the attention it receives by being isolated. However, the prime factor in balance is opposition, a line in opposition to another or an area lying in the opposite direction to another. (Fig. 3) Balance of interest is a little more difficult to achieve but may be accomplished by providing some detail in all parts of the design. Balance of interest may be eliminated entirely when a center of interest such as a beautiful stone is provided.

Another principle to be considered in design is repetition, for upon it rhythm is built. Just as rhythm in dancing is based on a repeat in the beat of the music, so is rhythm in design founded on a repetition of a shape, or a line, or a motif. Repetition is three or more of the same thing. It is always planned, whereas monotonous relationships are usually accidental. The repeat of the shape or line may be the same or different sizes. (Fig. 4) Of course, there is no limit on how many times an area or a line may be repeated. A border design may be repeated indefinitely.

There are formal designs and informal designs. Semi-formal designs are those in which the two halves are alike, as in a leaf. Formal designs may have any number of divisions, each one alike. If the design is based on even divisions such as six, there may be alternating motifs. The formal designs are based on repetition. In an informal design, the areas are all different and a pleasing effect is achieved by balance.

Now that the types of design and the principles of designing have been discussed, let us begin a design. For most people the best approach is to start with a definite shape. This may

FIG. 1

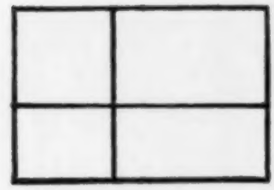


FIG. 2

FIG. 3

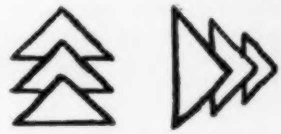
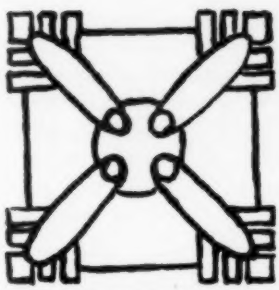
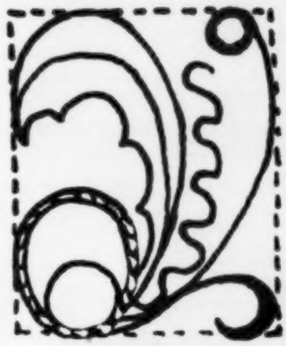


FIG. 4

SEMI-FORMAL



FORMAL



INFORMAL

FIG. 5

be a square, rectangle, triangle, circle, oval, quarter circle, half circle, etc. If your inclination runs to the modern type try a four sided shape which has unequal sides and angles which are not right angles, perhaps rounding off the corners.

The basic lines of design may be described as right angle lines, radiating lines, parallel lines, acute and obtuse angle lines, and curves both simple and complex. (Fig. 5) By breaking into a square or rectangle with lines parallel to the sides we would be using right angle lines and it would be our principle of repetition again, the repeat of a line. By cutting the outline of these shapes with lines parallel to the diagonals we would be co-ordinating the lines with the basic shape. By using the radii of a circle and lines parallel to the circumference, or even just any curve, we would be keeping the character of the shape, but making it more detailed. It is correct also to use curves in an angular shape; or angles in a curved shape. In fact, the best designs are composed of both angles and curves. Circular lines are classed as feminine and angular lines as masculine. The best families have both types. However, it is well to keep the character of the lines in mind when you are creating a design for a specific person.

A note of warning about the use of

*(Concluded on Page 26)*

# Strontia Crystal Cave?

(Prize question for July)*

Perhaps nothing ever created so much excitement and amazement on this wonderful island and the surrounding country, as did the discovery of this beautiful cave of "Crystaline Strontia."

In November 1897, on the property of Gustav Heineman, a well was dug some forty feet for water for domestic purposes. In making the excavation workmen passed close to a wonderful cave, the earth tumbling in and disclosing to them a stalactical cavern resembling a fairy grotto. On exploration it was found to be an immense stratum of strontia, a solid mass of dazzling mineral completely covering the interior of the cave.

The sidewalls were of solid strontia and the ceilings were archshaped and hung with prismatically formed crystals emitting prismatic colors fascinatingly splendid with brilliance. Strontia crystals have ten faces and the angle of each face on one crystal is exactly the same degree as that on the like face on every other crystal.

This cave was at this time said to be the only deposit of any size of strontium sulphate found anywhere in the United States and contained the largest strontia crystals in the world, the largest being eighteen inches long. It was known to geologists as an immense geode.

Strontia crystals are beautiful blue-white in color, and are very heavy. It takes but two fifty gallon barrels of it to weigh a ton. The salts of strontium communicate a vivid crimson color to flame and can be used in the manufacture of flares and fireworks.

*ALERT: One annual subscription to E.S.D. will be given the first person (earliest post-mark) reading this story, who writes us such details concerning the feature, as its exact location and owner; does it yet exist, if so, its present condition and availability; and what may have become of these magnificent strontia crystals. This information will be published and the subscription credited to advance, or, to any other person designated by the winner,

Mail to the Editor.

## INDIAN (from p. 11)

bowls, thus restored, were probably heirlooms of individuals or much-treasured by a community, probably to a certain reverence in which they were held.

Ed. Note: Mr. Kuhm is a director and past president of the Wisconsin Archeological Society and is Editor of the Trilobite, worthy bulletin of the Wisconsin Geological Society.

*All photographs thru courtesy of the Milwaukee Public Museum.*

* * *

## LET'S DESIGN (from p. 23)

**radiating lines do not neglect to provide interest at the focal point. The eye of the observer is led to the convergence of the lines. For this reason here is the logical place for the accent in the design, such as a gem stone in jewelry, and there is a feeling of frustration if no attraction is provided.**

**Nature forms such as leaves, flowers, stems, birds or animals may be used in design. Simplify them and they may be adapted to any of the forms of design.**

**Modern design seeks to escape the arc of a circle, a rhomboid instead of realistic; a flowing line instead of the a rectangle. All come back to the basic principles of variation in size, balance, and rhythm.**

* * *

**Florence K. Renaker is a member of The Chicago Lapidary Club and now lives in Medford, Oregon. She has taught design in the American Academy of Art of Chicago. It might also be noted that she is the only woman to go dofln the Colorado River alone. This was done several years ago when she was known as Miss Florence Kibbler, and as you recall there was much concern at the time as she was several days overdue on the trip.**

* * *

You will never be the same again, but watch for it! Worms, Earth Science, and Evolution by Burke Smith. See the September issue.

# Thomas J. Scanlon

With deep true sorrow we announce the passing away on June 5, 1953 of Thomas J. Scanlon, President of the American Federation of Mineralogical Societies and past President of the Midwest Federation of Mineralogical and Geological Societies and the Marquette Geologists Association.

Mr. Scanlon was primarily trained as a chemist but his natural interest in many things forced him not to confine himself to this field. Studies in sound directed his attention to the piezo-electric properties of quartz crystals. This started an interest that veered more and more to the field of lapidary, mineralogy and geology. The transformation was completed when his daughter took up geological studies at Wilson College. He provided himself with a complete lapidary workshop, designing and building much of the equipment himself. He acquired a fine collection of minerals and fossils, and, to round it all out, a large well-balanced library. Thus developed the Tom Scanlon so well known in the Earth Science field today.

For many years Tom was a faithful devotee to amateur mineralogy in all its branches in the Chicago area. Unsparing in his efforts to promote good things, he was a charter member of the Marquette Geologists Association, of the Midwest and American Federations, and a charter life subscriber to the Earth Science Digest. Needless to say, his influence has been felt in all parts of the country where rockhounds meet, since most of the Rock and Mineral clubs in the country are in some way associated with one or more of these organizations.

It is not given to many people to hold the honors that Tom has held; however it is the proof, if this be needed, of the great contribution he has made to popularizing the finest family hobby ever formed in this country. Through activities such as this, in which he has been a leader for many years, thousands of people have come to know the joys of rock collecting in the wide open spaces, in groups where the entire family participates, or the pleasure on winter evenings of making beautiful jewelry from the stones and gems they have collected. Not the least part of this hobby is the gathering together in groups to talk over one another's adventures, swap specimens and enjoy lectures and programs from experts in this field. This is what men like Tom Scanlon have done for this country—helping more than we casually realize to make it the great democracy that it is.

## 1882–1953

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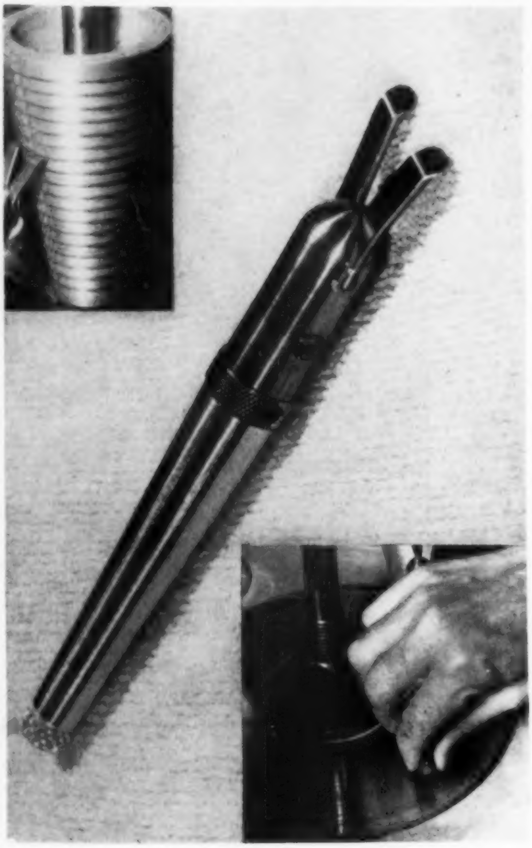

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# Chicago Lapidary Club's Gem and Jewelry Show

***Best of Show Award — Courtesy of Chicago Natural History Museum***

Nearly 2000 visitors were attracted to the Chicago Lapidary Club's third annual competitive Gem & Jewelry Show, held in Chicago's Gage Park field house, May 23-24. On display in the spacious exhibit hall was the finest array of amateur lapidary and silver work ever gathered together in the Midwest.

With a profusion of agate, jasper, obsidian, tiger-eye and petrified wood, as well as a scattering of crystal, bloodstone, opal and amethyst, gems displayed ranged widely through the quartz family. Among other gem families, jade, rhodochrosite and malachite were well represented, and garnet, aquamarine, sapphire and ruby (synthetic)

could also be viewed. Jewelry designs ranged from traditional to free form modern. For the first time faceted gems and enamel work were also included.

Helen and Goff Cooke's entry of a matched set of malachite jewelry was judged Best-of-Show. The Cookes, of the Chicago Rocks and Minerals Society, also won this honor in 1951. (See page 33.)

An outstanding non-competitive exhibit was that of K. Tsuisaki. Mention must be made of a few examples of his handicraft, including an exquisite madonna made from Wyoming jade, a marvelously detailed Japanese mask of dark green jade, an elaborately carved covered dish of light green jade, a number of tiny beautifully-made moss agate vases and a string of moss agate beads.

Many exhibitors showed great originality in their methods of display. Especially admired were Louis Statkus, cabochons of petrified "picture" wood and scenic agate displayed alongside oil paintings exactly reproducing the scenes in the gems.

Awards were made in ten craft divisions in both novice and advanced classes, with gold medals for first place winners and ribbons to all place winners. For best-of-show was awarded the special Dalzell Medal, a jeweled emblem of the Chicago Lapidary Club donated in memory of Robert Dalzell, one of the founders of CLC.

Prize-winning entries were scheduled for exhibit at the Chicago Museum of Natural History during the month of June and at the famous State Street establishment of C. D. Peacock, July 13-25.

It was agreed by all that this was the Chicago Lapidary Club's most successful gem and jewelry show.

## Collecting Can Be Dangerous

Last fall the entire Rockhound fraternity was immeasurably shocked and saddened on learning of the untimely accidental death of Frank Campell, of Detroit, while on a post-convention collecting trip at the Priday Ranch in Oregon.

Now comes news of another tragedy, which occurred when University of Illinois geologist, Dr. J. S. Templeton, was almost instantly killed, on April 21, along the Mississippi River in St. Paul, Minnesota, when a large boulder became dislodged and tumbled down on him from the cliff above.

In company with Dr. H. B. Wellman, also of the University of Illinois, they were exploring and studying the rock formations along the Mississippi river gorge when the accident occurred. While Dr. Templeton was being removed to the ambulance, another boulder became dislodged, striking Patrolman Walter Heuer, and injuring his right leg.

Falling rocks are always a hazard when collecting along the face of a precipice, but almost equally dangerous chances are taken by those who go out too near the edge of the top, where a false step might mean a plunge of hundreds of feet. Many times these edges are undercut and overhanging dangerously in a manner that cannot be readily detected from above.

Deep, cold waters, filling old quarry pits and strip-mine diggings, may be equally dangerous, as they frequently contain sharp "drop-offs" in the most unsuspected places. Unless one is positively familiar with his ground, extreme caution is more often the part of wisdom.

## Cover Photo

Angel Falls, recently established as the world's highest waterfall (3,212 feet)—more than twice the height of the Empire State Building—spurts from the top of the three-hundred-square-mile mesa, called Devil's Mountain, in Venezuela's Gran Sabana, a high jungle region stretching between the Orinoco and Amazon Rivers, which was the setting for Sir Arthur Conan Doyle's famous novel, "The Lost World." This photograph was taken by Nicol Smith, well known lecturer, who made the expedition to the falls by Grace Line "Santa" ship, trailer, airplane and dugout canoe. Grace Line Photo

# Personalities In Earth Science
# The Cookes

To write about one's self and his or her avocations can at times be a most trying and difficult task. This is one of those times.

To begin with, people in all walks of life, of both high and low degree, acquire hobbies and interests of very dissimilar kinds with varied attributes because of various interesting circumstances and reasons. Though they be many and often misunderstood, there is always a motivating force of one kind or another that inspires the hobbyist on and farther afield.

In my particular case, it was a challenge that was presented to me in the form of a Christmas package, a motion picture camera complete with film and other accessories. Accompanying the gift there was an appropriate card with a challenge neatly inscribed, "Other women's husbands make movies. Why can't you?" As you have already surmised, the gift was from my far sighted and adventurous wife, my partner in the team that has become known as Helen and Goff.

Prior to our marriage, and the later advent of the camera, I had as a child and a youth, crossed the North American continent several times during which I stored up a considerable amount of information relative to landscape geology and erosion, and a vague knowledge of there having been many pre-history people on this continent. My first acquaintanceship with the descendants of those early people was in the Canadian Northwest Territories in 1904. Two trips to Europe, one with my parents as a child and one in the early twenties broadened my interest and understanding of economic geography and populations. Such were my early roamings and education.

Marriage did not settle me nor my inspiring helpmeet down. While residing in Kentucky for seven years we were in and out of many caves, both known and unknown, large and small. It was there that we first began collecting, the gathering of fossiliferous material, the evidence of the once mid-continental seas. Fossils

**Cooke Family — Goff, Helen and Daughter Virginia en route to Lukuchukai County of Arizona**

***Goff and Helen Cooke (Chkago Tribune Photo)***

and onyx were our great interest then.

After our return to Chicago, the lure of the West and the urge to return to the golden wide open spaces and the majestic mountains of my youth eventually became a reality with our first Western trip to the Rockies in 1938. Amateur motion picture cameras and film at that time were not the accurate complex mechanisms that they are today and our early attempts to record on film the awe inspiring vistas as presented by the forces of Nature were not all that was to be desired.

Down through the years, our quest for pictures has led us back each vacation into many out of the way places, some far from the beaten path; up and down and over mountains, such as the inhospitable Chuska, across frightening desert lands of southeastern Utah and northern Arizona, lava fields and into the land of the Lukuchukai. Time and again we have forded flood canyons and washes that demand the respect of all.

As the years sped by the urge to record the spectacular erosion features of the Four Corners Country and the Southwest for others to enjoy, gradually became a "must" so that today we have accumulated about 10,000 feet of film, featuring mountains, deserts, canyons, forests, arches, bridges and pre-history ruins that are in evidence almost everywhere on the Great Colorado Plateau.

Unfortunately or otherwise, a person's hobby eventually takes on many facets. Ours is no exception. Each new location for pictures presented attractive and interesting semi-precious specimens of rocks and minerals to be gathered as mementoes to enhance a collection to display to friends—"brag-about" pieces.

One cannot for long travel the length and breadth of the colorful Southwest without sooner or later becoming interested in the native arts of the descendants of the Ancients, particularly the art of stone grinding, polishing, and the fashioning of silver jewelry. Our interest became a desire to do likewise. In due time we experimented, and experimentation produced results that we now rarely show.

Time, perseverance, and tribulations which upon occasion were most discouraging, eventually produced handiwork that we can now acclaim as personally hand fashioned.

Many of our 'brag-about' pieces of rock have become cabochons in silver. Despite our successes, we still bow to the excellence of the craftmanship and ingenuity of America's first silversmiths who had only the crudest of tools to work with—the people whose work first inspired us. Ars longe; Vita brevis.

Ed. Note—The above sketch was hurriedly prepared on a last minute request of the editor. It does not mention that the Cookes have long been active members and officers of Chicago Rocks and Mineral Society, that this is the second year that they have won the Grand Award at the Chicago Lapidary Show, nor that they have given programs thruout the Great Lakes area. But one must know them personally to fully appreciate them.

* * *

Another lost gold mine by the lost mine artist, Victor Shaw. See the September issue for the Lost Black Maverick.

* * *

## Eastern Federation of Mineralogical and Lapidary Societies' 1953 Convention

This will be the second show put on by the Eastern Federation, and if their goal of surpassing last years' show is realized, it will truly be a very worthwhile show. The convention has no specific host society; it is the joint effort of all New Jersey societies. Some attractive features are planned. A silent auction will be run daily—if they don't get you or you don't get your specimens the first day, just try the next—Oct. 8, 9 and 10. And another nice feature—the treasure hunt—especially that part which "guarantees all participants of the field trip an opportunity to find one or more excellent specimens at location"—Oct. 11. And free identification service, too. The 1952 show drew people from 32 states and 3 foreign countries. We predict they will beat last year's show—that is, meet their goal.

# Midwest Federation Bulletin

**Edited by Bernice Wienrank, Staff Member**

WISCONSIN GEOLOGICAL SOCIETY held its annual banquet May 8. The door prize for the evening, a year's subscription to the *Earth Science Digest*, donated by Paul Scholz, was won by George Recht.

Gene Knoshe was awarded the first annual Junior Trilobite Trophy, a porcelain rockhound flushing a Calymene Niagarensis, for the best article submitted by a junior member during 1952-3 to the society's bulletin, *The Trilobite*. Honorable mention was given Dennis Glowenka, John Raasch and Dale Berg.

ILLOWA GEM AND MINERAL SOCIETY during the entire month of May staged an exhibit of fossils, minerals, gems and jewelry in the Davenport Public Museum. Lecture tours of the various displays, conducted by IG&M president Irving Hurlbutt, were a very popular feature of the exhibit. The working exhibits also drew large crowds.

CENTRAL IOWA MINERAL SOCIETY on May 1 enjoyed a panel quiz on various phases of rock and mineral hobbies. The following were the members of the panel and their specialties: Sgt. Auchard—cabochons, Dorothy Hays—micromats, William Brunia—sphere-cutting, Helen Ward—fossils and Leslie Crosman—petrography (optical mineralogy). Following the quiz, petrographic slides were shown by Leslie Crosman.

NORTHWESTERN MICHIGAN MINERAL CLUB on April 8 elected the following officers: Jim C. Moulton, president; Hugh Graham, vice-president; and William Nash, secretary-treasurer.

CHICAGO LAPIDARY CLUB—p. 29.

CENTRAL ILLINOIS ROCKHOUNDS SOCIETY'S first public exhibit, held May 2-3, was visited by more than 700 persons and received excellent write-ups in the local newspapers. Displays in the show included rocks, slabs, gemstones, jewelry, fossils, and Indian relics. A special display by the Illinois State Geological Survey also was in the exhibit.

CHICAGO ROCKS AND MINERALS SOCIETY on April 11 heard Dr. William Powers, geographer at Northwestern University, discuss the geography of the United States. Via colored slides, Dr. Powers took the group on an 8000 mile tour of the U.S., portraying some of the most spectacular scenery in the country on the screen.

GEODE ROCKS AND MINERALS SOCIETY on March 27 featured a display of fluorescent rocks by Mr. A. B. Howard and a talk on "Polished Agates" by Charles Gillette, who also exhibited stones of that type.

GR&MS elected the following officers for 1953: E. N. Smith, president; Raymond Colton, vice-president and Earl Smith, secretary-treasurer.

CINCINNATI MINERAL SOCIETY at its March meeting heard James Stephens of the University of Cincinnati speak on "Looking for Gold in California." During early geologic eras, according to Mr. Stephens, masses of granite were raised up from the depth of the earth to form dikes. It is in these dikes that gold is found. Gold-bearing gravels result from the erosion of the upper portions of the granite. When the gold-bearing gravels have been covered by lava, placer mining is used to reach the gold. In some sections of California, placer mining has been discontinued because of the damage to farm lands by the depositing of gravel in the course of the operation.

EVANSVILLE LAPIDARY SOCIETY at its March meeting viewed "The Story of Gems," a film on gems and gem-cutting.

Following the film, ELS held its first auction, on which it cleared $150. The money will be used to buy additional equipment for the club's lapidary shop.

INDEPENDENCE GEM AND MIN-

ERAL SOCIETY on May 3 made a field trip to Ross Quarry at Ottawa, Kansas. Numerous silicified brachiopods and six fine trilobite tails were collected. In the inside of some of the hollow brachiopods were found spirals of pyrite crystals. Also picked up were calcite crystals in the rather rare rhombohedron crystal form instead of the usual six-sided pyramids. Following a basket lunch at the home of Mr. A. C. Carpenter, the society viewed Mr. Carpenter's outstanding mineral and fossil collection. The group then drove south of Ottawa where members collected fossil fern leaves, calamite leaves and calamite stems.

MARQUETTE GEOLOGISTS ASSOCIATION on May 3 was addressed by Mr. Hal R. Straight, an expert on paleobotony and a former president of the Midwest Federation. Mr. Straight chose as his subject, "Identification of Petrified Woods." He illustrated his lecture with slides and displayed numerous specimens of petrified wood, including a beautiful limb of precious opal.

EARTH SCIENCE CLUB OF NORTHERN ILLINOIS on April 10 learned that quartz was more than just a pretty crystal, when Dr. B. J. Babbitt, noted engineer and physicist, discussed for the group "Quartz—The Crystal." He dealt largely with the piezoelectric properties of quartz, the properties that make quartz so valuable in communication systems. According to Dr. Babbitt, "Diamonds have hardness, iron has magnetism, but quartz has rhythm."

OREGON AGATE AND MINERAL SOCIETY at its April meeting received instructions on "How to Operate a Tumbling Mill." The demonstration and lecture were given by Melvin Kathan.

MINERALOGICAL SOCIETY OF PENNSYLVANIA on May 3 held its annual meeting in the quarry of J. Showalter, Blue Bell, Pennsylvania. After a brief business meeting, members gathered minerals from the quarry. They obtained calcite, dolomite, rutile, pyrite, quartz, fluorite and hematite.

HUMBOLDT GEM AND MINERAL SOCIETY during June had an outstanding display of gems and jewelry at the Redwood Acres Fair. The display will be repeated at the Humboldt County Fair, to be held during August.

EL PASO MINERAL AND GEM SOCIETY has issued the following rules on specimen collecting to its members:

1. Ask permission to enter property
2. Carry no guns or liquor
3. Close all gates
4. Be careful about fire
5. Be moderate in the amount of material taken
6. Leave a clean camp site

Any member who breaks these rules forfeits his membership in the organization. It would be well if these rules were incorporated into the by-laws of every earth science and lapidary club.

CHEYENNE MINERAL AND GEM SOCIETY on May 1 enjoyed an interesting discussion by Louis Steege on Wyoming Indian artifacts. Mr. Steege illustrated his talk with specimens of Yuma points, Folsom points, Sandia points, Plains Indian arrowheads, axes and scrapers.

SHADOW MOUNTAIN GEM AND MINERAL SOCIETY at its April meeting heard Mrs. Emma Clark speak on "Iris Agate." On display was Mrs. Clark's collection of this rare and beautiful agate. Though scarce, iris agate has been found in nearly every state in the West.

HOLLYWOOD LAPIDARY SOCIETY gathered on May 1 to hear James J. Boutross, President of the Empress Pearl Syndicate, tell about "The Life History of the Pearl." Every type of pearl was on display.

DONNA ANNA COUNTY ROCKHOUND CLUB at its April meeting became acquainted with its local gem stones when Ruth Gilgore showed and explained examples of rough and polished gems found in Donna Anna County.

EVERETTE ROCK AND MINERAL CLUB at its April meeting was given a demonstration by Joe Swartz on sphere cutting. Mr. Swartz also showed his own excellent collection of spheres.

NORTH LINCOLN AGATE SOCIETY will hold its Eleventh Annual Agate Show on July 25 & 26 in the Delake Grade School on Hi-way 101, Delake, Oregon."

SOUTH BAY LAPIDARY SOCIETY will hold its Fourth Annual Show on Sept. 19th and 20th, at Clark Stadium, 861 Valley Drive, Hermosa Beach, Calif. Open—Saturday noon to 10 P.M., and Sunday 10 A.M. to 6 P.M. Exhibition includes everything of interest to the rock collector from rocks as picked up in the field to the cut and polished stones and jewelry pieces. Outstanding specimens of minerals, woods, etc. Members will be with their exhibits to answer questions and explain working methods. This will be another fine show as this Society is noted for its interesting shows. Admission free.

## RECOMMENDED READING FROM ALL (AVAILABLE) SOCIETY SOURCES

"Jade—From Then to Now," by Charles N. Schwab, April issue of the *Nebraska Rear Trunk*. Includes many valuable hints on polishing jade.

"Damascus Steel," by Jay E. Farr, May issue of the *Earth Science News*. Describes an ancient method of tempering steel.

"April and the Diamond," by Necro Mancer, April issue of the *Evansville News Letter*. Provides a wealth of ancient lore and superstition about the diamond.

"Tin," by Forest Ingram, May issue of the *Gemrock*. Tin has many other industrial uses besides coating "tin" cans.

"Importing Rocks from Mexico," April and May issues of the *Voice*. Explains the import and export laws of both the United States and Mexico. A "must" if you plan to collect in Mexico.

"The Historic Role of the Rivers of Georgia," by M. Thomson, Spring 1953 issue of the *Georgia Mineral News Letter*.

Rivers play an important part in a region's history.

"The Question and the Answer," by Edward Soukup, May issue of The *San Diego Shop News and Notes*. Explains the difference between imitation, synthetic, reconstructed and genuine gems.

"Weathering and Mass-Wasting," by Juliet C. Reed, April issue of the *Keystone Newsletter*. Gives a full explanation of the various processes of weathering and mass-wasting.

"The Beryl Family,"by Clarence LaReau, May issue of the *Template*. Tells how color makes the difference between an ordinary aquamarine and a rare emerald.

*Societies are urged to send reports of their activities to this department, c/o Bernice Wienrank, 4717 N. Winthrop Ave., Chicago, Illinois.*

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Our friends who are endeavoring to spread the gospel of soil conservation could not do better than give this "injun" yarn the widest possible circulation. A farm journal, the Farmer-Stockman, printed a picture of a deserted farm house and gullied field, offering a prize for the best 100-word description. Here's the winning entry as quoted by Outdoor America:

"Picture show white man crazy. Cut down tree. Make big tepee. Plow hill. Water wash. Wind blow soil. Grass gone. Door gone. Window gone. Whole place gone . . . Buck gone. Squaw, too. Papoose gone. No chuck-away. No pig. No corn. No plow. No hay. No pony.

"Indian no plow land. Keep grass. Buffalo eat grass. Indian eat buffalo. Hide make tepee. Make moccasin. Indian no make terrace. No build dam . . . All time eat. No hunt job. No hitch hike. No ask relief. No shoot pig. Great Spirit make grass. Indian no waste any thing. Indian no work. White man he loco."

If there has ever been a better argument written for soil conservation we've yet to see it.

(Cont. from p. 14)

*Stage of Development Classification*

By use of simple ratios it is possible to demonstrate the close relationship that exists between the diameters, depth, and circularity of the individual potholes. Namely, circularity approaches 1.000 (Table II) when the depth-diameter ratio is 1.000 or greater. The converse appears equally true, circularity is low when the depth-diameter ratio is less than 1.000 (Table III).

A stage of development classification based on these dimensional relationships of 20 potholes recognizes *Youth*, *Maturity*, and *Old Age*:

*Youth.* In Youth the maximum diameter exceeds depth, and the pattern normal to the depth is non-circular (Table III).

*Maturity.* In Maturity the depth is equal to or greater than the maximum diameter, and the hole is highly circular in outline (Table II).

*Old Age.* Old Age is the stage of destruction wherein the stream bed is lowered more rapidly than potholes are deepened.

Conditions of the stream and bedrock in Old Age suggest probable completion of the pothole cycle during the youthful stage of the stream cycle, or during the time of youthful stream conditions. (Tables II and III on p. 44.)

TABLE I

| Pothole | Diameters Max. | Diameters Min. | Depth | Depth-Diameter | Circularity |
|---|---|---|---|---|---|
| | | LOWER AREA | | | |
| 1. | 96* | 96* | .. | .... | 4.999* |
| 2. | 72* | 72* | .. | .... | 0.999* |
| 3. | 72* | 60* | .. | .... | 0.833* |
| 4. | 40 | 26 | 14 | 0.350 | 6.650 |
| 5. | 17 | 14 | 14 | 0.824 | 0.824 |
| 6. | 23 | 13 | 8 | 0.347 | 0.565 |
| 7. | 32 | 20 | 12 | 0.375 | 0.625 |
| 8. | 80 | 62 | 32 | 0.400 | 0.775 |
| 9. | 95 | 76 | .. | .... | 0.800 |
| 10. | 89 | 62 | .. | .... | 0.697 |
| 11. | 28 | 27 | 42 | 1.500 | 0.964 |
| 12. | 43 | 32 | 25 | 0.581 | 0.744 |
| 13. | 52 | 39 | 52 | 1.000 | 0.750 |
| 14. | 34 | 32 | 54 | 1.588 | 0.941 |
| 15. | 50 | 36 | 55 | 1.100 | 0.720 |
| 16. | 58 | 39 | .. | .... | 0.672 |
| 17. | 55 | 38 | .. | .... | 0.691 |
| 18. | 54 | 52 | .. | .... | 0.963 |
| 19. | 45 | 41 | .. | .... | 0.911 |
| | | MIDDLE AREA | | | |
| 20. | 14.5 | 13 | 16 | 1.103 | 0.897 |
| 21. | 5 | 5 | 9 | 1.800 | 0.999 |
| 22. | 16 | 14.5 | 32 | 2.000 | 0.906 |
| 23. | 32 | 21 | 15 | 0.469 | 0.656 |
| 24. | 47 | 37 | 25 | 0.532 | 0.787 |
| 25. | 15.5 | 11 | 10.5 | 0.677 | 0.710 |
| 26. | 15 | 10.5 | 4.5 | 0.300 | 0.700 |
| 27. | 30 | 22 | 17.5 | 0.583 | 0.733 |
| | | UPPER AREA | | | |
| 28. | 57 | 39 | 70 | 1.228 | 0.684 |
| 29. | 67 | 53 | 45 | 0.672 | 0.791 |
| 30. | 8 | 7.5 | 13 | 1.625 | 0.938 |
| 31. | 15.5 | 13.5 | 23 | 1.484 | 0.871 |
| 32. | 38.5 | 24 | 32 | 0.831 | 0.623 |
| 33. | 168* | 112* | 72* | 0.429 | 0.666 |
| 34. | 18 | 15 | 69 | 3.833 | 0.833 |
| 35. | 35 | 33 | 36 | 1.029 | 0.943 |

* Approximate values.

## TABLE II

### MATURE POTHOLES HAVING HIGH CIRCULARITY

| *Pothole* | *Diameters* *Max.* | *Min.* | *Depth* | *Depth-Diameter Ratio* | *Circularity* |
|---|---|---|---|---|---|
| 11. | 28 | 27 | 43 | 1.536 | 0.964 |
| 14. | 34 | 32 | 54 | 1.588 | 0.941 |
| 20. | 14.5 | 13 | 16 | 1.103 | 0.897 |
| 21. | 5 | 5 | 9 | 1.800 | 0.999 |
| 22. | 16 | 15.5 | 32 | 2.000 | 0.968 |
| 30. | 8 | 7.5 | 13 | 1.625 | 0.937 |
| 31. | 15.5 | 13.5 | 23 | 1.484 | 0.871 |
| 35. | 35 | 33 | 36 | 1.029 | 0.943 |
| | | | Average: | 1.521 | 0.940 |

## TABLE III

### YOUTHFUL POTHOLES HAVING LOW CIRCULARITY

| *Pothole* | *Diameters* *Max.* | *Min.* | *Depth* | *Depth-Diameter Ratio* | *Circularity* |
|---|---|---|---|---|---|
| 4. | 40 | 26 | 14 | 0.350 | 0.650 |
| 5. | 17 | 14 | 14 | 0.824 | 0.824 |
| 6. | 23 | 13 | 8 | 0.347 | 0.565 |
| 7. | 32 | 20 | 12 | 0.375 | 0.625 |
| 8. | 80 | 62 | 32 | 0.400 | 0.775 |
| 12. | 43 | 32 | 25 | 0.581 | 0.744 |
| 23. | 32 | 21 | 15 | 0.469 | 0.656 |
| 24. | 47 | 37 | 25 | 0.532 | 0.787 |
| 25. | 15.5 | 11 | 10.5 | 0.677 | 0.709 |
| 26. | 15 | 10.5 | 4.5 | 0.300 | 0.700 |
| 29. | 67 | 53 | 45 | 0.672 | 0.791 |
| 32. | 38.5 | 24 | 32 | 0.831 | 0.623 |
| | | | Average: | 0.530 | 0.707 |

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Answers: Test your knowledge. Check ones which you have answered correctly.

a.—(1) An intimate, homogeneous mixture of two or more metals, usually produced by fusion.
b.—(1) The common name for sulphur, dating back to remote antiquity.
c.—(1) A cavity (usually small) in a rock, often lined with crystalline incrustations.
d.—(1) One of the varities of chalcedonic silica (quartz) usually of organic and/or precipitated origin.
e.—(1) The science or study of rocks, their origin and mineralogical content.
f.—(1) A growth or segregation of mineral substance about a nucleous, usually a precipitation of some soluable mineral like quartz or calcite.
g.—(2) The upper (ridge) portion or part of folded rock structure—opposite to syncline.
h.—(2) A division or state of matter approaching molecular dimensions, dispersed in a solvent.
i.—(2) Literally, fair weather. A mine unusually profitable in operation.
j.—(3) A carving or engraving on a stone or gem; also a stone or gem so carved.
k.—(3) Pertaining to tree-like or branched markings or crystalizations associated with rocks or minerals.
l.—(3) A barren or unprofitable mining operation. The opposite of bonanza.

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WANTED—Will pay $1.00 each for copies of Earth Science Digest of August 1946, September 1946, March 1947; 50¢ each for October 1946, and December 1946; Sept.-Oct. 1947; and January 1949. EARTH SCIENCE DIGEST, Box 1357, Chicago 90.

MINERAL COLLECTION FOR SALE. 200 Specimens, some fossils and fluorescents, $50.00. GUILD, 630 Greenleaf Ave., Wilmette, Ill.

*(Continued on Page 48)*

## BOOK REVIEWS

PALOMAR, THE WORLD'S LARGEST TELESCOPE, by Helen Wright. New York: The MacMillan Co., 188 pp., $3.

This remarkably concise, non-technical and readable account of the 200 inch Hale telescope on Mt. Palomar, northeast of San Diego, and of the twenty years of financial, technological and personal effort that went into making it a reality is from the pen of a young woman astronomer. She has made clear what the great telescope means in extending our vision out into space, using diagrams and pictures freely to explain how the giant eye works, and what the visitor to the observatory will see from the observation gallery. Her first chapters on the history of telescope will be of interest to the general reader.

THE CREATION OF THE UNIVERSE, by George Gamow. New York: Viking Press, 144 pp., $3.75.

With this general discussion of the origin and the destiny of the universe, Dr. Gamow, professor of theoretical physics at the George Washington University, completes a trilogy, of which the other two members are *The Birth and Death of the Sun* and *Biography of the Earth*.

Dr. Gamow belongs to the group which believes the universe had an origin in time and an end in space. The point of view which his equations convince him is a probable explanation of these gigantic questions postulates that the matter of the universe was once a highly compressed, atomically undifferentiated mass, which was dispersed in an hour throughout all space. In some 30 million subsequent years, this matter, now made up of atoms, formed into turbulent gas clouds like the spiral nebulae and gradually collected into the stars and planets and galaxies that we know today. Dr. Gamow makes a readable and intelligible account of this vast concept, although the reader will find that the more mathematics he has the easier he will follow the argument. The book is well illustrated.

**LIMESTONES OF EASTERN OHIO, by Raymond E. Lamborn. Geological Survey of Ohio, Columbus, 4th Series, Bulletin 49, 1951, 377 pages.**

This bulletin reports a detailed study of the limestones in forty-one eastern counties of Ohio. In the region thus defined, the sedimentary series exposed at the surface consists of beds of Upper Devonian, Mississippian, Pennsylvanian and Permian ages, and have a total vertical thickness of more than 3,000 feet. The main part of the bulletin is a county by county description of the stratigraphic sequence, the character, thickness, and distribution of the limestone formations involved, and a detailed study of their composition. Many detailed stratigraphic sections are presented measured to the nearest inch along with numerous careful chemical analyses. This bulletin is intended especially for those who may be interested in the usable limestone resources of the state. It might be of interest to the layman, however, since the location of many outcrops is indicated.—*W.H.P.*

**"LEGAL GUIDE FOR CALIFORNIA PROSPECTORS AND MINERS." Published by the California Division of Mines, Ferry Building, San Francisco 11.**

Although the basic regulations for locating and patenting mineral claims are relatively simple, a number of side issues are involved, owing to the dual control exercised by state and federal governments over public lands, so that this up to date summary of the law under which one of the great mining states operates is of value not only to Californians but also as a general guide to anyone wishing to claim mineral rights in any state. Among subjects discussed in the booklet, prepared under direction of L. A. Norman Jr., are: Manner of locating and holding mineral claims in California; mineral patents, state lands, mining claims within national forests, appropriation of water, water pollution, safety regulations, ore buyers licenses and federal gold regulations.

**SCHMUCK- UND EDELSTEIN-KUNDLICHES TASCHENBUCH**, by Karl F. Chudoba and Edward Guebelin. Bonn: Gedrdr. Scheur, 1953; 158 pp., DM 19.60. (Pocket Manual of Ornamental and Precious Stones).

This a-little-large-for-pocket-size book is crammed with an enormous mass of highly valuable information for the professional gemmologist, the student, and the amateur. In addition to chapters on Nomenclature, Glossary of Gemmological Terms, Chemical Data, Crystallography, Physical Constants, Optical Characteristics, X-ray Investigation, Diagnostic Inclusions, etc., there are numerous tables with concentrated and valuable information. There are also discussions on synthetic stones, covered or coated stones, imitations, and the gemmological microscope.

Under the back cover there is inserted under a linen strip a separate pamphlet containing 124 views of photomicrographs of inclusions, markings and other characteristics of interest and value.

Two gorgeous color plates give the book added attraction. J.D.W.

**"A NATURAL HISTORY OF WESTERN TREES"**, by Donald Culross Peattie. Boston: Houghton Mifflin Co., 751 pp., $6.

Natural history manuals, whether of birds, trees or animals, are often forbidding with their classification apparatus, fit only for one as learned as the author. But Donald Culross Peattie is a rarity among authors in this field; he is a writer with more than a touch of poetry in his soul as well as being a trained botanist. He grew up in Chicago surrounded by the relatively sparse forests of the prairies, but now in his adopted home in California he has explored the great forests of the west, with their giant sequoias and pines, most glorious trees in the world, has read deeply into the history of their discovery, of their exploitation, and their present status, and has investigated their economic usefulness. All this treasure trove is gathered into little essays of appreciation about each species of tree, served up with a maximum of literary art and a minimum of technical detail, and spiced with uncommonly good black and white drawings by Paul Landacre.

This is a perfectly sound tree manual; but it is something more. In fact, it is perhaps the most solid single achievement of a man who has done as much to interpret nature to the common man as anyone of this generation.—R.P.M.

COLORADO GEM TRAILS, by Richard M. Pearl, $2.25, published by the Mineral Book Co., Box 183, Colorado Springs, Colo. This book is now available again in a revised Limited Edition. New features are: new sketch map of the Ruby Mountain locality, revised mileage logs for the Mount Antero and Calumet localities, and other changes in text and illustrations.

Retained are the features that have made this book an indispensable field guide for the Colorado Gem and Mineral Collector: Collecting conditions, Land ownership, Local transportation, Gem and mineral collections open to the public, Gem and mineral societies welcoming visitors, Official map, History of gem production, References for study and research, and Photographs of Mount Antero and Mount Sneffels. BJB.



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**CLASSIFIED ADS—**

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